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PROGNOSTIC IMPLICATION OF ADMISSION HYPERGLYCAEMIA IN NON-DIABETIC ACUTE MYOCARDIAL INFARCTION PATIENTS, A PROSPECTIVE OVERVIEW

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Abstract

Background: Elevated admission glucose levels in non-diabetic patients with acute myocardial infarction are independently associated with large infarct sizes and a higher mortality rate when compared with patients with normal glucose levels. A strong correlation between glycaemia and shock or development of heart failure has also been reported. This study was carried out to assess the prognostic implications of admission hyperglycaemia in non-diabetic acute myocardial infarction patients.

Aim and objectives: This study was conducted to assess the prognostic implications of admission hyperglycaemia in non-diabetic acute myocardial infarction patients.

Methodology: The study became conducted on 200 non diabetic STEMI patients admitted in the hospital. Patients with acute myocardial infarction proven by ECG, cardiac enzymes (positive Troponin I or CPK-MB) and symptoms suggestive of acute myocardial infarction who have no previous history of diabetes with HbA1c <6.5 were included in the study.

Results: Amongst patients with admission blood glucose ≤140 mg%, 8 patients (8.10%) developed cardiogenic shock, 5 patients (5.40%) developed arrhythmias, 4 patients (4.05%) developed AV block (≥2nd degree) and 7 patients (6.75%) died all through the hospital live. Amongst patients with admission blood glucose >140 mg%, 21 patients (21.05%) developed cardiogenic shock, 18 patients (18.42%) developed arrhythmias,14 patients (14.47%) developed AV block and patients (14%) died during the hospital stay. The complications and mortality were significantly higher in patients with admission blood glucose >140 mg%.

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Conclusion: Hyperglycaemia at admission in non-diabetic patients of acute ST elevation myocardial infarction is strongly associated with higher in hospital complications like cardiogenic shock, arrhythmias and AV block and hospital stay mortality.
Keywords: Hyperglycaemia, AV block, ST elevation

1. INTRODUCTION

Stress hyperglycaemia represents increased blood glucose levels that is result of activation of neurohormonal processes in organism exposed to stress. Increased glucose level during stress is evoked by integrated hormonal, cytokine and nervous counter regulatory signals on glucose metabolic pathways and, therefore, presented in the same time with hyperinsulinemia and insulin resistance. The mortality and morbidity of a diabetic patient is poor as compared to non-diabetic patient.[1] elevated admission glucose levels in non-diabetic patients with acute myocardial infarction are independently associated with large infarct sizes and a higher mortality rate when compared with patients with normal glucose levels.[2] A strong correlation between glycaemia and shock or development of heart failure has also been reported.[3,4] Acute hyperglycaemia in healthy subjects and in patients with impaired glucose tolerance or overt diabetes produces a rise in inflammatory markers. Following this line of idea, it might be speculated that the detrimental effect of stress hyperglycaemia in acute MI might also stem from its ability to increase inflammation.

This study was conducted to assess the prognostic implications of admission hyperglycaemia in non-diabetic acute myocardial infarction patients.

2. METHODOLOGY:

The study was conducted on 200 non diabetic STEMI patients admitted in the hospital.

Inclusion criteria:

Patients with acute myocardial infarction proven by

- ECG (ST segment elevation in at least 2 contiguous leads)
- Cardiac enzymes (Positive Troponin I or CPK-MB)
- Symptoms suggestive of acute myocardial infarction who have no previous history of diabetes.
- Patients with HbA1c <6.5

Exclusion criteria:

- Patients who present with Non-ST Elevation MI (NSTEMI).
- Patients with a previous history of diabetes mellitus.
- Patients receiving drugs that are known to elevate blood sugar levels (e.g. Corticosteroids)
- Patients who received dextrose containing intravenous fluids before admission.
- Time from the beginning of symptoms to admission to Critical Care Unit more than 48 hrs.

A complete history of all patients was noted. All patients 'blood sample was collected on admission for estimating plasma glucose level. Complete general and systemic examination of the patients was done. ECG of all the patients were read and recorded. Patients were examined for complications of AMI including arrhythmias, cardiogenic shock, conduction

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abnormalities. Patients were grouped in to 2 categories according to their admission blood glucose levels,

Group A: Blood glucose level ≤ 140 mg%.

Group B: If their blood glucose level is >140 mg%.

The groups were compared to demonstrate correlation between stress hyperglycaemia and cardiovascular outcomes of arrhythmias, cardiogenic shock, AV block and death. Normality of data turned into tested by Kolmogorov-Smirnov test. If the normality was rejected then non parametric test was used. Quantitative variables were compared using independent t test/Mann-Whitney test (when the data sets were not normally distributed) between the two groups. Qualitative variables were correlated using Chi-square test/Fisher's exact test. Univariate and multivariate logistic regression was used to assess the significant risk factors of RBS>140. The data was entered in MS EXCEL spreadsheet and analysis was done using Statistical Package for Social Sciences (SPSS) version 25.0

3. RESULTS

There were 100 patients in group A and 100 patients in group B.

Sex distribution: There was total 120 males and 80 females in the study. There has been no significant difference between the number of males and females in two groups (p= 0.894).

Age distribution: The mean age of patients in Group A and Group B were 62.45 ± 12.24 and 61.14 ± 11.35 respectively. Median age in group A and group B were 65 and 62 years respectively. There was no significant difference in patients' mean age in between the groups (p= 0.608).

Personal and past history: There were total 42 (21.33%) smokers in the study of which 23 were in group A and 19 in group B. History of smoking was present in 24.32% and 18.42% of patients of group A and group B respectively. There has been no significant difference in number of smokers in between the two groups (p= 0.378). There has been total of 50 patients with history of alcohol consumption in the study. Group A and institution B, both had 25 patients and there was no significant difference in number of patients with history of alcohol consumption among the two groups. The history of high blood pressure became present in 45 patients of which 20 patients were in group A and 25 patients in group B. There was no statistically significant difference in number of hypertensives between the two groups.

HbA1c levels: Mean HbA1c level in group I and group II were 5.46 and 5.5 respectively. The difference between them was insignificant (p= 0.475) indicating that patients in both the groups had similar glycaemic status prior to myocardial infarction and the hyperglycaemic response was secondary to stress.

General physical examination:

Variable	Group A	Group B	P value
Mean heart rate (beats/min)	76.88 ± 12.75	81.83 ± 13.52	0.023
Mean SBP (mmHg)	125.49 ± 25.75	111.58 ± 25.25	0.001
Mean DBP (mmHg)	79.08 ± 13.64	71.47 ± 14.17	<0.001

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This table shows mean heart rate, systolic blood pressure and diastolic blood pressure between the two groups. There was a statistically significant difference in heart rate, SBP and DBP between the two groups.

Development of complications: Total 14.66% of patients developed cardiogenic shock. 8 patients (8.10%) in group A and 21 patients (21.05%) in group B developed cardiogenic shock. There was statistically significant (p= 0.0.5) increase in number of patients developing cardiogenic shock in group B. A total of 18 patients developed arrhythmias of which 5 patients (5.40%) were in group A and 18 patients (18.42%) in group B. There was a statistically significant increase in number of patients with arrhythmias in group B (p= 0.022). Total 18 patients (9.33%) in the study developed an AV block of ≥2nd degree. 4 patients (4.05%) in group A developed AV block (≥second degree) and 14 patients (14.47%) in group B developed AV block. There was a statistically significant (p=0.046) increase in patients developing AV block in group B. Total 28 patients (14%) died during the hospital stay. 7 patients (6.75%) from group A died during hospital stay while 21 (21%) patients from group B died during hospital stay. There was a statistically significant (p= 0.012) increase in hospital stay mortality in group B patients. Univariate logistic regression analysis was carried out to adjust the effect of confounding factors. It was found that hyperglycaemia was associated with heart rate, SBP, DBP, cardiogenic shock, arrhythmias, AV block and death.

4. DISCUSSION

Mean age of patients in the present study was 61.79 ± 11.78 years. Mean age of patients in the study by Rafael et al[2] on 834 patients was 64 ± 13 years. Mean age in the present study was close to the literature There were 42 smokers, 45 hypertensives and 50 patients with history of alcoholism. There was no significant difference in the quantity of smokers, hypertensives and alcoholics in between the two groups. hence, both the groups were similar regarding distribution of risk factors. The mean heart rate in the gift study was 79.39 ± 13.34 bpm. The mean heart rate within the study by Rafael et al.[2] was 79 ± 22 bpm which is close to the present study. The mean heart price in group i was 76.88 ± 12.75 bpm and in group B was 81.83 ± 13.52 bpm in the present study. There was a statistically significant increase in heart rate in group B i.e. Patients with hyperglycaemia. That is in concordance with the previous studies by Kadri et al. And Suleiman et al. And Modenese et al.[5-7] The probable explanation for this might be increased sympathetic tone in patients with stress hyperglycaemia. There was a statistically significant fall in both SBP (p=0.004) and DBP (p<0.001) in group B patients as compared to group A patients. Possibly explanation for this might be due to the reason that studies reported that patients with stress hyperglycaemia have poor LV function and lower ejection fraction.[5] Previous studies have reported similar results with respect to mean SBP and DBP.[5,6] incidence of cardiogenic shock, arrhythmias and AV block (≥2nd degree) was located to be significantly greater among stress hyperglycaemic patients. Kadri et al.[5,] Modenese et al.[8], Zhou Na et al..[7], Rafael et al.[2] and Aggarwal et al..[9] Also found significantly higher incidence of these complications in hyperglycaemic patients which became consistent with our study. The hospital stay mortality was 6.75% in group A

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and 21.05% in group B patients which was statistically significant indicating stress hyperglycaemia to be an indicator of hospital stay mortality. The mortality in the studies by Suleiman et al. [6] and Timmer et al.[10] were 29% and 36% in the hyperglycaemic group which were relatively higher as compared to other studies due to the fact that they refer to 30-day mortality and 8-year mortality respectively. Rest of the studies indicate in hospital mortality which became significantly higher in hyperglycaemic group being consistent with the findings of the present study. The exact mechanism through which hyperglycaemias worsens the prognosis of ischemic patients has now not been well established. Its pathophysiology is believed to be based on endothelial and microvascular dysfunction, causing a prothrombotic state produced by vascular inflammation. The endothelial dysfunction inactivates nitric oxide and increases oxidative stress, responsible for the production of oxygen reactive species[11]. The production of those radicals activates transcription and growth factors and secondary mediators. Through direct tissue lesion or activation of those secondary mediators, hyperglycaemias-induced oxidative stress causes additional lesion to myocytes.[11,12] There is evidence that the prothrombotic state generated by hyperglycaemias originates from reduced plasma fibrinolytic activity and action of tissue plasminogen activator.[13]

5. CONCLUSION

Hyperglycaemia at admission in non-diabetic patients of acute ST elevation myocardial infarction is strongly associated with higher in hospital complications like cardiogenic shock, arrhythmias and AV block. Hyperglycaemia at admission is a strong predictor of early mortality during hospital stay. Though hyperglycaemias at admission is a strong predictor of in hospital complications and mortality, it is not an independent predictor of either of them. stress hyperglycaemias are also associated with significantly lower systolic and diastolic blood pressure and higher heart rate at admission.

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